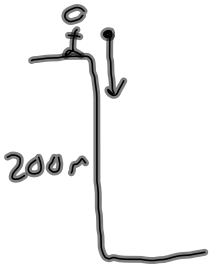
Quarter Exam:

- Kinematics:
  - 1-D motion
  - Projectile Motion
- Forces
- Work, Energy, Power
  - Work-Energy Thm.
  - Conservation of Energy
  - Power
- Momentum
  - Impulse-Momentum
  - Conservation of momentum

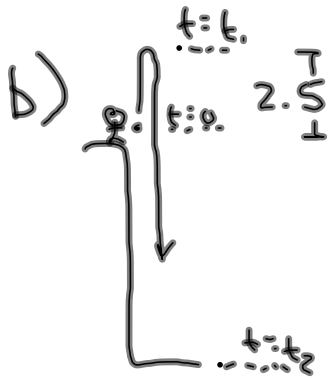
A person is standing on a cliff that is 200 m above the ground.
a) If he drops a stone from the cliff, find the time it takes to hit the ground (ignoring air resistance).
b) If he instead throws the stone directly upwards at 7 m/s, how long does it take to hit the ground?



a) $\Delta y = \cancel{v_i t^0} + \frac{1}{2} a_g t^2$

$t = \sqrt{\frac{2\Delta y}{a_g}}$

$= 6.39\ s$



b) $\cancel{v_f^0} = v_i + a_g t_1$

$t_1 = .71\ s$

$\Delta y = v_i t_1 + \frac{1}{2} a_g t_1^2$

$= 2.5\ m$

$\Delta y = \cancel{v_i t_2^0} + \frac{1}{2} a_g t_2^2$

$\Delta y = 202.5\ m$ $\quad t_2 = \sqrt{\frac{2\Delta y}{a_g}}$

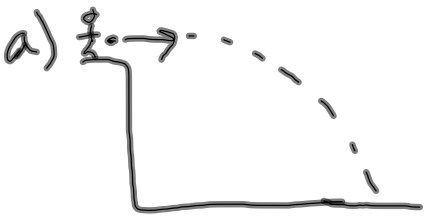
$= 6.43\ s$

$\text{total time} = t_1 + t_2$

$= 7.14\ s$

A stone is thrown from the top of a building horizontally with an initial speed of 20.0 m/s. The height of the building is 45.0 m.
a) How long does it take the stone to reach the ground?
b) What is the speed of the stone just before it strikes the ground?
If instead the stone is launched with an angle of 30 degrees at 20 m/s, repeat parts a and b.

a)



$\Delta y = 45\ m \quad t = ?$

$v_{ix} = 20\ m/s \quad v_{fx} = ?$

$v_{iy} = 0\ m/s \quad v_{fy} = ?$

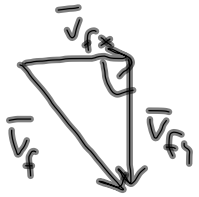
$\Delta x = \quad v_f = ?$

$\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$

$t = 3.03\ s$

b) $v_{fy} = v_{iy} + a_g t$ $\qquad v_{ix} = v_{fx} = 20\ m/s$

$= -29.7\ m/s$



$v_f = 35.8\ m/s$

Repeat a) $\qquad v_{ix} = (20\ m/s)\cos(30°) = 17.3\ m/s$

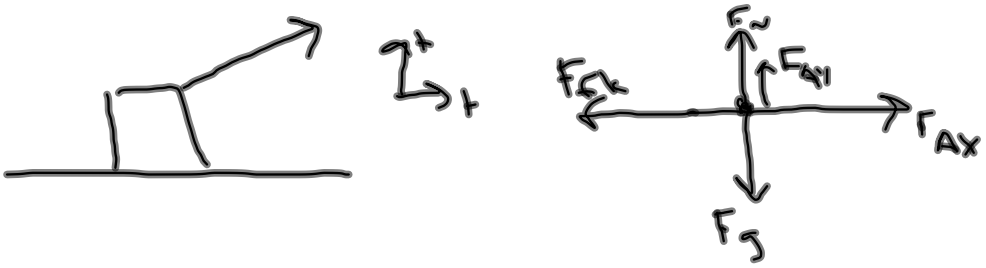
$v_{iy} = (20\ m/s)\sin(30°) = 10\ m/s$

$t = 4.22\ s$

$\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$

b) $v_f = 35.8\ m/s$

A 15 kg sled is being pulled across a horizontal surface at a constant velocity. The pulling force has a magnitude of 83.5 N and is directed at an angle of 30 degrees above the horizontal. Determine the coefficient of kinetic friction.



$$F_{fk} = \mu_k F_N$$

$$\mu_k = \frac{F_{fk}}{F_N}$$

$$= \frac{F_A \cos(30^\circ)}{mg - F_A \sin(30^\circ)}$$

$$= 0.68$$

$$\Sigma \vec{F}_x = 0$$

$$F_{Ax} - F_{fk} = 0$$

$$F_{fk} = F_{Ax} = F_A \cos(30^\circ)$$

$$\Sigma \vec{F}_y = 0$$

$$F_N + F_{Ay} - F_g = 0$$

$$F_N = F_g - F_{Ay}$$

$$= mg - F_A \sin(30^\circ)$$

A 300 kg log is pulled up a ramp by means of a rope that is parallel to the surface of the ramp. The ramp is inclined at 31 degrees with respect to the horizontal. The coefficient of kinetic friction between the log and ramp is 0.90, and the log has an acceleration of 0.90 m/s/s. Find the tension in the rope.

Two blocks are connected over a massless pulley by a rope. The first block is on a table and weighs 426 N, and the second is hanging off the table and weights 195 N. Ignore friction and air resistance, and find the acceleration of the two blocks.